THE

YOUNG MECHANIC.

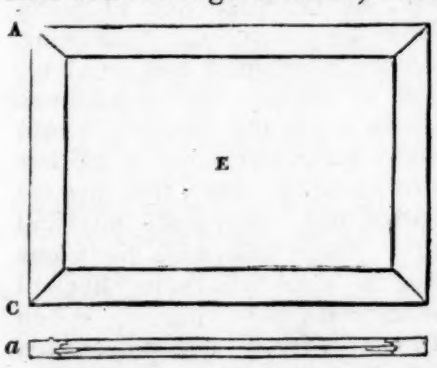
VOL. I. JUNE, 1832. No. VI.

OBSERVATIONS ON DRAWING INSTRUMENTS.

Continued from p. 68.

THE DRAWING BOARD.

THERE are many different forms of the drawing board, some being only plain pieces of pine with square edges, the paper being glued, or confined by tacks, or small pins with large flat heads. Another means of securing the paper, is by a long screw which passes through the board, and which has a very thin square or octagonal head, which drops into a small cell made in the top of the board. On the opposite end is a nut by which the head of the screw, after it is passed through the paper, is drawn close into the cell, and thus at the same time makes no elevation above the surface of the paper, which can obstruct the passage of the square or other rulers over it. The best and most convenient kind of drawing board consists of a rectangular frame, ABCD, represented below, of mahogany,



into which a pannel E, of some kind of well seasoned wood is fitted, and secured by buttons or cleats, as seen in the section at *ab*. They are made of all sizes, but that which is intended for a half sheet of the imperial paper, will be found generally speaking the most useful. The paper is to be damped with a clean, soft sponge on the side on which the maker's name appears, and laid upon the pannel ; then the frame is placed upon it, and pressing it down, the pannel is forced in, which is to be immediately buttoned all round. When dry, the paper will present an even and uniform surface for drawing on. There has been some improvement made in this kind of board; the frame has slips of box or other light colored wood inlaid, and these being divided into those scales which

are most frequently required, will be found very convenient to work from without compasses. The divisions on the adjacent sides of the board are of the same scale, but those on the opposite are of different values. This renders the use of the board more extensive, because it is the two adjacent sides only which are used for the same drawing, one being for the measurement of length upon it, the other for the heights of elevation. The student may easily ascertain at any time if the two sides of his drawing board preserve their perpendicularity to each other, simply by setting his bevel square as before explained, and applying it to the edges of the board. This should always be done once or twice a week, and particularly if any sudden change in the weather has occurred since last using it. If any derangement has taken place in the meantime, he should have it put in proper order before using it. Attention to these little matters always denotes a good workman, and cannot fail to produce his drawings all the credit due them.

SPOUTING OF FLUIDS.

Hydraulics is a science which treats of the velocity of fluids. It has always been considered a curious and interesting inquiry, to investigate the causes by which water spouts from several vessels to different heights and distances.

Upon the principles of hydraulics, many useful machines are constructed; and many kinds of mills, several engines used in the mechanic arts, pumps, fountains, &c., are the effects of hydraulics judiciously applied. If we knew with certainty the mass, the figure, and the number of particles of a fluid in motion, the laws of its motion might be determined by the resolution of a mathematical problem, viz. by finding the motion of a system of small free bodies acting, one on another, by the influence of some exterior force, as that of gravity. But we are very far from being in possession of the data requisite for the solution of this problem; and if we were, it would be difficult to deduce any satisfactory results from the intricate calculations in which the question would be involved. Some have attempted to infer the laws of motion in fluids from the equilibrium of their particles; but these are so complicated as to be of no particular use. Accurate physical investigation is previously necessary. Those who wish for clear ideas on the subject, should endeavor to establish their physical principles on experimental facts and accurate observations. When water spouts from a hole in the bottom of a vessel, it first descends in a vertical direction, and the surface deviates very little from a horizontal plane, but at about three or four inches from the bottom the particles turn from the vertical direction, and proceed from all parts with a motion, more or less oblique towards the aperture. The same thing takes place when the water spouts from a small hole in the side of a vessel. The tendency of the particles towards the orifice is a necessary consequence of their perfect

mobility ; for they are thus naturally directed to that part where they meet with the least resistance, which part is the aperture.

At a small distance from the bottom of the vessel, the fluid forms itself into a kind of funnel, whose point corresponds with the centre of the hole. When the fluid runs out of a hole in the side of a vessel, it forms a kind of *half funnel*, beginning when the surface nearly touches the upper edge of the hole. It is probable that the funnel begins to be formed as soon as the fluid begins to run, but it does not become very sensible, except when the surface is at a small distance from the bottom.

The funnel commences at a greater height from the bottom of the vessel in proportion as the bottom is larger. The size, however, is varied from a number of circumstances.

The velocity of a fluid spouting from a small hole in the bottom of a vessel is equal to that which a heavy body would acquire in falling perpendicularly from a height equal to that of the surface of the fluid above the aperture.

The same law takes place when the hole is in the side of the vessel; for the pressure of the fluid is equal, at the same depths in all directions, and will consequently produce the same velocities.

The velocity of a fluid issuing from the hole will carry it to the same height as the surface above the aperture, in the same manner as a body falling from a certain height acquires a velocity sufficient to make it ascend to the height from which it falls.

From the theory of falling bodies, we infer, that if the fluid continued to move uniformly with the velocity it had acquired at coming out of the aperture, it would move through a space equal to double the height of the fluid above the aperture, while a heavy body was descending through the same space. The height being the same, the velocity of the fluid above the aperture will be always the same, and this, though the fluid varies in density; for though with a denser fluid the pressure is greater, the mass escaping is also greater; and the velocities are equal when the moving forces are proportional to the masses they put in motion.

The spouting of fluids through lateral orifices depends upon this principle—that the pressure against the side of a vessel increases in proportion to the depths, but the velocity of a spouting fluid, which depends upon the pressure, increases only as the square root of the depths. Suppose a vessel having two pipes, or orifices, one an inch from the surface of the fluid, and the other four inches, the latter will discharge double the quantity of water in the same time as the former.

The velocity of water spouting from an orifice is continually decreasing in the following proportion, as 9, 7, 5, 3, 1.

That is, if a vessel be divided into 25 parts, and filled with water, and a hole be made in the bottom, 9 parts will run out, say in one minute; 7 in the next, 5 in the third, 3 in the fourth, and 1 in the fifth, agreeably to the above position. On this principle, Sir Isaac Newton's water clock, or *clypsidra*, was constructed, which would keep very exact time as long as the water was running out,

which was through a very small aperture. It may be constructed in the following manner. Take a small cylindrical vessel, and having ascertained the time it will take to empty itself, divide by lines the vessel into particles which are to one another as the odd numbers 1, 3, 5, 7, 9, 11, &c. Thus suppose a vessel require 36 hours to empty itself, divide it first into 36 parts, then beginning at the surface take 11 of these parts for the first hour, 9 for the second, 7 for the third, and so on to the last, and it will be found that the surface of the water will descend regularly through each of these divisions in an hour.

If a prismatic vessel be filled with water, and the water be allowed to run out by an aperture in the bottom, observe the time employed in running out. When empty, again fill the vessel, keeping the surface of the water at the same height. In the same interval of time in which the vessel was emptying itself in the first instance, nearly double the quantity of water has been expended in the second.

In practice, the water often issues from lateral openings, which, though small, in comparison to the size of the reservoir, cannot be considered as having all their points at an equal distance from the surface of the fluid. In these cases, the usual method of ascertaining the quantity of water flowing through the aperture depends on the following principle. Imagine the hole to be stopped by a very thin plate pierced with a great number of holes, through which the water escapes. Now consider each of these holes as a single insulated aperture, the velocity for each will be according to the correspondent height of the fluid. If the number of holes be infinitely augmented, or which is the same thing, if the plate be removed, the velocity at each point of the given aperture will be as the height* corresponding to the same; and in determining the quantity of fluent water, regard must be had to this inequality of velocity.

In treating of the velocity of spouting fluids, I have not noticed friction, which in long tubes considerably lessens the velocity of water. J. R. C.

PATENTS FOR MASSACHUSETTS.

GRANTED IN OCTOBER AND NOVEMBER, 1831.

October.

54. For a *cooking stove*. Samuel Beals, Boston, Oct. 1.

55. For a machine for *spinning hemp and flax* and other fibrous substances. Daniel Treadwell, Boston, Oct. 11.

56. For *tubular essence phials*. John Staniford, Boston, October 17.

57. For an improvement in the *book binder's cutting press*. Charles Stimpson, Boston, Oct. 17.

58. For an improvement in making *glass knobs*. Spencer Richards, Cambridge, Oct. 31.

November.

59. For a composition to be used in the *stiffening of hats.* Charles Bent and Francis Bush, Chelmsford, Nov. 3.

60. For improvements in the manner of *straightening the toggle joints in the hand printing press.* Otis Tufts, Boston, Nov. 7.

61. For a process for *dying cotton* in the staple, or cotton wool. James Roy Stewart, Lowell—an alien who has resided two years in the United States, Nov. 11.

62. For combined *grist and saw mills.* Noah Sortee, Boston, Nov. 17.

63. For an improvement in the machine for *polishing and graining or dicing morocco*, or other leather, patented on the 20th April, 1831. Robert Emes, Boston, Nov. 21.

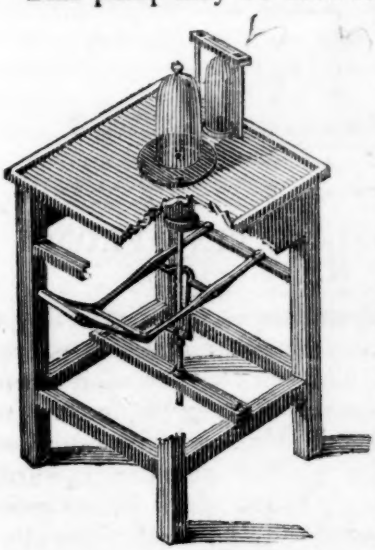
64. For an improvement in the mode of *scouring, smoothing, burnishing, &c.* all kinds of tanned skins, or leather. Robert Emes, Boston, Nov. 21.

65. For a *chemical water proof cement* for preserving brick and wood work from the injurious effects of water. Charles Fletcher, Boston, Nov. 22. *Journal Franklin Institute.*

AIR-PUMP.

MESSRS. EDITORS—I send you the engraving of an air pump, which has been found to answer a good purpose for experimenting before large assemblies. A description of it will be found in the Boston Mechanics Magazine, p. 246. T. C.

This pump may be used either for exhausting or condensing, and

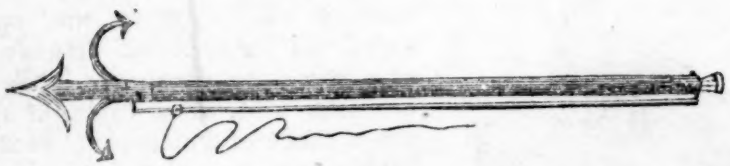


besides being useful for all the experiments with common air, may be employed for transferring gases from one vessel to another. This pump consists, first, of a table, or framework, made of mahogany, twenty-two inches square, with four legs resting on the floor; its height is several inches above that of the lecture table. In the centre of this table a hole is cut, three inches diameter, for the admission of the pump-barrel, which is two inches internal diameter, and 8 1-2 inches long; a ground brass plate, ten inches diameter, is attached to one end of the barrel; this plate rests on the top of the table, and the barrel projects through the hole before described. The piston is worked by a lever of the second order, having its fulcrum in the back legs of the table. This lever is attached to the piston rod, by two vibrating rods, which assist in preserving the piston and rod in a direct line coincident with the

centre of the barrel. On the table, another ground plate, five inches diameter, is placed by the side of the plate mentioned above; a brass tube passes from this small plate to the pump-barrel, and is inserted just below the valve, which is situated near the top of the barrel; this valve opens downwards. There is another valve in the tube, opening towards the small plate; and the piston is a solid one without a valve.

The mode of operation is as follows:—Place a receiver on the large plate, depress the piston, and the air will pass through by the valve into the barrel; in raising the piston, the air is forced through the tube, and by another valve, when it escapes at the centre of the small plate; so that exhausting is performed by using the large plate, and condensing by using the small one; and no alteration in the pump is necessary, in changing from the one to the other. There is a screw by the side of the large plate to admit the air into the receiver, and another screw by the side of the small plate to let the condensed air escape; one of the valves may be got at by unscrewing a brass piece in the centre of the large plate; the valve is attached to the under side of this brass piece; it is covered with a little cup, to retain the oil and keep the valve moist: the other valve may be repaired by unscrewing the small ground plate. There is a cup screwed to the lower end of the barrel to prevent the oil from running down to the floor.

The opening under the table is for a drawer to contain the small articles used with the pump. It will be necessary to hang a weight of thirty pounds on the cross piece below the pump handle; this will keep the frame very steady. The condensing receiver is held down by screws.



MURRAY'S INVENTION FOR SAVING FROM SHIPWRECK.

Several ingenious methods have been proposed for effecting a safe communication between the stranded ships and the shore. Mr. Trenghouse suggested a rocket, Captain Dansey a kite, and Captain Manby a shell, for the purpose of carrying out a line to the ship in distress. The plan of Captain Manby was thought so well of at first, that it was honored with a Parliamentary reward, and very great exertions have been made to introduce it into general use. But it has been found attended with so much difficulty, even under the most favorable circumstances, and has in not a few instances failed so decidedly, that it has been only very partially adopted, and has not effected any material diminution in the general loss of life by shipwreck. From the weight of Captain

Manby's apparatus, it is not quickly transportable from the few stations which are provided with it, to the immediate scene of danger; and when the rope is projected it too frequently snaps in two. A transport was wrecked only three miles from Mundesley, where there was one of Captain Manby's safety-mortars, but before it could be conveyed to the spot, the ship had gone to pieces, and all on board perished. In another case, of a ship wrecked off Whitby in 1820, within 60 yards of the shore, the shot, in the first attempt, fell short; the rope, in the second, broke; and the ship and crew were buried in the breakers. On many parts of the coast there is not even this imperfect apparatus of Captain Manby. So late as December, 1830, one of the most frequented, and, at the same time, most dangerous parts of the British coast—that between Plymouth and the Land's End—was so entirely destitute of every sort of means for saving shipwreck mariners, that of the passengers and crews of 23 vessels which went on shore in the dreadful storm of that month, only two men and a boy were saved!

Frequent reflection on these distressing facts has led Mr. John Murray (the popular lecturer on chemistry, and the author of many excellent scientific works) to the invention of the apparatus represented in the prefixed engraving, and described in a pamphlet which we have now before us.* Mr. Murray first tried to project from a common musket an arrow with a line attached to the feather end, but the arrow became *reversed* in its transit through the air, and the following improved and very ingenious arrangement was therefore adopted.

'The figure represents the form of the arrow, as best constructed for the common blunderbuss, and may be propelled immediately from the shore, or carried with the life boat. The butt-end carries a thin metallic shield, or plate, which may be made of copper. The point is sharp and barbed, to fasten where it may trike, or act as a holdfast on the tackling or rigging of the wreck. It is shod with iron, as well to subserve this purpose as to secure its direction, and compete with the resistance it must encounter in a storm. The wood used is hiccory, or ash, or still better, lance wood, the more cohesive the fibre the better; this is withed in its extreme length with whip thread or line; bands or ribbons of thin metal strengthen the arrow, where the bent extremities of the parallel iron rod pass through, and which last are further secured by a shoulder on one side and a nut on the other. Along this parallel rod glances the iron ring to which the line is attached, the instant it leaves the gun, and a bit of cork, or caoutchouc, toward the end of the arrow, interposed between the rod and the body of the arrow, acting as a recoil spring, will so far subdue the effect of friction.

* Invention of an effective and unfailing method for forming an instantaneous communication with the shore in shipwreck; and illuminating the scene in the dark and tempestuous night. By John Murray, F. S. A. &c. 30 pp. 8vo. Whittaker and Co.

'The entire weight of the arrow, thus plumed and shod, is from two to three ounces, eighteen inches long, and three quarters of an inch in diameter. These dimensions and weight have been found more efficient and successful when applied to a blunderbuss sixteen inches long in the barrel, and 1 1-0 inch diameter in the calibre. The entire weight of the arrow and its appendages, together with the strong whipcord attached to it, was two pounds and one ounce, and were carried to an extent of nearly one hundred yards by two drachms of gunpowder. The cord was of sufficient strength to pull a rope from the shore large enough to form a communicating medium of escape from the wreck.

'When applied to a three-pounder swivel, the arrow and its various adjustments weigh together nearly two pounds; and with three ounces of gunpowder a line of considerable strength and power will be propelled upwards of a hundred and fifty yards. In this instance a macharel, or deep sea-line, may be used. The cord is coiled in the form of what is called *French faking*, and was the plan adopted in all our experiments, which seems best adapted to preserve the coils from being entangled—a circumstance of the highest importance in experiments of this description. The barb is removed here to render the appearance less complicated.

'The arrangement is supplied with an appendage for illuminating the flight of the arrow and scene of shipwreck. It consists simply of a cylindrical sheath, or socket, containing the materials of illumination, consisting of a mixture of finely powdered chlorate of potassa and sugar candy, intimately blended together. A spindle supplied externally, with a flat head, enters by its extreme end into a miniature phial supplied with sulphuric acid, sealed with a drop of bees' wax. As soon as the arrow leaves the gun, the reaction of the air on the head of the spindle drives inward the plug of wax and liberates the acid, which instantly kindles the mixture, the brilliant flame immediately fills the globular cage of wire gauze which surmounts it, and the intensity of the light is rendered still more dazzling and splendid by adding a bit of phosphorus to the inflammable powder. This part of the apparatus is made altogether independent of the arrow, and may be easily attached when circumstances require it, as when the darkness of the night renders it imperative. The combustion which forms the source of the illumination, cannot be quenched either by the sea spray or a deluge of rain, the medium of support being supplied from itself, altogether independent of the external atmosphere, however charged with watery vapour or rain, and the combustion is too fierce to be at all affected by the wind, even at its maximum degree of strength.'

The 'experiments' alluded to in the preceding extract are detailed more at length in a subsequent part of the pamphlet, and leave no doubt on our minds, that Mr. Murray's apparatus is by far the most efficient that has yet been devised; while, at the same time, it is so cheap and portable, that inclination alone is all that can be wanting to bring it into universal use.—*Lon. Mec. Mag.*

RUSSIAN SCHOOL OF ARTS AND TRADES.

The Russian government have just established a seminary of this description at St. Petersburgh, under the title of The Technological Institution. One hundred and thirty-two pupils are to be educated within its walls, at the expense of the state. They are to learn the theory of technicology, the construction of machinery, chemistry, the art of dyeing, &c.; and peculiar advantages are held out to such as distinguish themselves. These latter are to be exempt from the poll-tax and military conscription; are not to be subject to corporal punishment; may take up certain branches of industry without an apprenticeship, and hand down these privileges to their children, who shall be entitled to enjoy them so long as they continue to follow their father's calling. They are to be styled artizans or masters; and independently of the pupils to be educated at the public expense, who are to be chosen from the middling classes, other youths may avail themselves of the Institution, on terms to be prescribed. A sum, equal to £5500, is to be annually appropriated to its support; and gratuitous instruction in the art of design is to be given to the lower orders of mechanics, after morning service on Sundays and holidays. The buildings for this establishment have been erected on the site of what was once a morass in front of Jaegerhof; and two spacious fields, ornamented with rows of wild chesnuts, have been set apart for the scholars' recreations. It was opened on the 23d of October last.—*Quarterly Journal of Education.*

NEW APPLICATION OF LITHOGRAPHY.

Col. Peabody and Mr. Dixon, have been conducting a course of experiments in Salem, in order to ascertain the practicability of counterfeiting engraved Bank Notes, by means of an entirely new process of lithography. It has resulted in a conviction that all printing, whether by type or engraving, can be transfered to stone (fifty times or more)—and whereas once so transfered may be multiplied almost without end. The specimens of printing in this way are so perfect that they cannot be distinguished from the originals—and it is of no importance whether the impression were recent or very old. The danger to the community from this discovery that Bank notes and other securities may be easily and perfectly counterfeited, is so evident as not to require illustration. The art however is yet a *secret*—and it is a particularly fortunate circumstance that a process has been discovered by which the copying of such securities by Lithography may be effectually prevented. A patent has been secured for this purpose.

The conclusion arrived at is, that no security to the public is now offered by the use of Perkin's stereotype plates—since a perfect *fac simile* can be made of the Bank notes impressed with his plates by transferring them to stone. So important is this annunciation, that Col. Peabody has thought it best to publish a card, explaining more

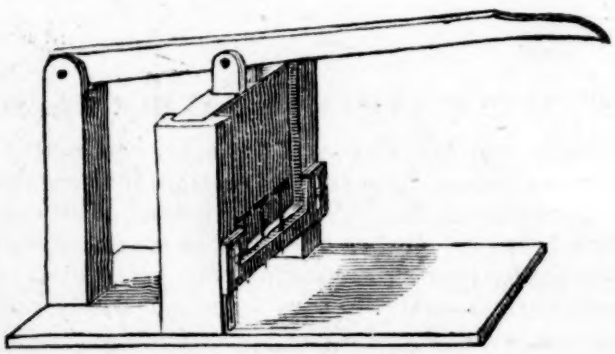
particularly the result which he has obtained—in order that the public may not 'prematurely' distrust the present circulating medium. We extract the most important paragraphs:

'The specimens of bank notes which we have already copied, are not perfectly executed; and the reason is, that not being familiar with the manipulations of the lithographer, we have not been able to bring up the work after it was affixed to the stone, so well as we otherwise should have done. Were a skilful workman to undertake the process under our direction, I have little doubt that Bank notes might be perfectly printed by our method. In fact, the mode of proceeding which we have adopted, has been explained to one of our best lithographers, and he is of opinion, that a few experiments would ensure success.

'With regard to Perkin's plate, I am perfectly satisfied that it presents a better safeguard against counterfeiting by engraved plates, than any plate now in use which I have seen. A patent has been secured for a process, which will effectually prevent the copying of monied securities by Lithography; and it was thought best not to publish any thing on the subject, until the Banking Institutions might have an opportunity of satisfying themselves of the value of the security, and adopting it.

FRANCIS PEABODY.'

May 26, 1832. *Even. Gaz.*



PRATT'S STABBING PRESS.

In a preceding number of the Mechanic, I observed an article headed Book-Binder's Stabbing Press—invented by the proprietor, John Mead, of Boston. From a perusal of the article, I took the machine to have been recently invented, and as yet but very little in use. While reading the piece and viewing the cut representing the machine, I was peculiarly struck with the resemblance that it bears to one which has been in use in this place for twelve years, and which has all the facilities attached to it which are specified as belonging to the beforementioned machine. The Stabbing Machine to which I allude, was invented by Mr. Simeon Pratt of this city, at a time when he had about 10,000 pamphlets to stitch, and which previously must be stabbed. To

obviate the difficult task of stabbing with a hand awl, as was the usual practice, he set himself to work, and after fixing upon several plans, succeeded in adopting the one we have mentioned, and which by experience has been found to answer every purpose both in making holes for stitching and for strapping.

The difference between the two machines, appears to be very trifling; both are forced with a lever, and work under similar constructions. The awls in the latter are made fast to a slide, which moves upwards and downwards, and which may be set to any distance apart, as the book may require. To the perpendicular pieces in which the slide moves, is attached a horizontal piece of wood, secured by screws, which prevents the book from rising with the awls after being stabbed, and which leaves the book perfectly free. This piece is so made as to be set according to the thickness of the book or books to be stabbed. The utility of these machines in this place have been realized, and the great saving of time appreciated.

S. H. COLESWORTHY.

Portland, May 8, 1832.

[This machine acts upon the same general principle, as that described on page 62; yet its form of construction and the materials of which it is composed are very different. This is made of wood, whereas Mr. Mead's press is of iron, and takes up less room, on account of the position of the handle.

The only difficulty with the Boston press is with the awls, which require a peculiar temper and some ingenuity in using them. We think there need be no apprehension as to the use of this machine, especially, after twelve years experience in Portland.

This communication shows also very clearly the value of a vehicle like the Young Mechanic, by which improvements in the Arts may be made known.—EDS.]

LIST OF SOCIETIES IN BOSTON,

Whose objects are, entirely or in part, the improvement of the mind.

Massachusetts Charitable Mechanic Association—Boston Mechanics Institution—Boston Society for the Diffusion of Useful Knowledge—Society of Natural History—Massachusetts State Lyceum—Boston Lyceum—Mechanics Lyceum—Social Lyceum—Young Men's Association for the Promotion of Literature and Science—Boston Debating Society—Franklin Debating Society—Boston Debating and Elocution Society—Speculative Society—Critical Club—Mercantile Library Association—Mechanic Apprentices Library' Association.

There may be other societies devoted to similar objects with the preceeding, with which we are not acquainted. If this is the case, we shall be glad to be favored with their names for publication hereafter. There are several Associations for moral and intellectual improvement in the city, the names of which are not made public. Regular courses of lectures are also given during the winter season besides those delivered before the various Associations. We wish to publish a list of the Societies of mechanics

in the country at large, and shall esteem it a favor to be furnished with the names of any that our friends may be acquainted with, together with a brief account of their objects and method of prosecuting them. Accounts of the societies in the city, will be published as we shall have opportunity.

NEW PUBLICATION.

FIRST BOOK OF THE FINE AND USEFUL ARTS, for the use of Schools and Lyceums—compiled by Marshall S. Perry, M. D. Boston, Carter and Hendee. 12mo.pp. 126.

WE think a work of this character is called for at the present time. Besides the valuable information it affords to the young student, it is well calculated to incite a deep interest in the study of the fine and useful arts, and thereby to prompt him to the perusal of more elaborate treatises. It also meets the wants of those classes of the community who have not time to read, or are not able to purchase, expensive books on the various arts, as the series will probably furnish all the information that is absolutely necessary in the common walks of life. It seems to be compiled with good judgment; and we do not hesitate to recommend it as affording, at a cheap rate, an amount of knowledge of the arts which every citizen ought to possess. We think the following extract on Lithography will be acceptable to our readers.

'LITHOGRAPHY is the art of printing or taking impressions from stone. It was invented by Alois Senefelder, at Munich, about the year 1796. The father of Senefelder was an actor. It was his intention to have educated his son for the profession of law; but this did not suit his taste; and after his father's death, he attached himself to the theatre, and became an author. He was reduced in his circumstances; and being in search of some cheap way by which he might print his own works, he accidentally made the important discovery of this art. His mother requested him one day to make out a bill for washing clothes, and not having paper at hand, he wrote the list of articles on a stone which he had prepared for the purpose of etching. Some time after, when he was about to erase the writing, the thought occurred to him, that by preparing the stone with aqua-fortis, and applying printers ink to it, it might be possible to take impressions from it as from wood engravings. He tried this and several subsequent experiments, and the result was the art of lithography.

Senefelder at first made his discovery a secret; but in 1799, the King of Bavaria gave him an exclusive privilege to practice his new art for fifteen years, after which he made no exertion to keep a knowledge of it from the world.

The art was introduced into England about the year 1802, and into France in 1807, by M. Andre, a musical composer, who disposed of the secret to all who would purchase it for a given sum. His first attempts, however, at printing, were rather unsuccessful. Count Lasteyrie distinguished himself by his exertions to advance the art. He visited Germany for the purpose of acquiring information, and while there, he engaged a Mr. Engelman to study the

art at Munich; after which, in conjunction with several other gentlemen, he set up a lithographic establishment in Germany. In 1816, Mr. Engelman opened a printing establishment in Paris, where he soon had six presses in operation. The art now assumed a considerable degree of importance, artists of ingenuity turned their attention to it, and daily improvements were made. Lithography was first successfully practised in America by Mr. Wiliam Pendleton, about the year 1824.

The stone used for lithograpic drawing is a sort of calcareous slate, composed of the carbonate of lime with a small portion of iron. The best stone is found in the vicinity of iron mines; it is usually of a bluish white color, and of fine grain.

The best lithographic stones are found at Solenholfen, a village upon the banks of the Danube. The country around abounds with them, and the place derives its greatest importance from this source of traffic. The stones are found at the depth of ten or fifteen feet from the surface of the earth, in horizontal strata of various thicknesses. They can be easily split to the proper thickness, which is about two or three inches. They should be entirely free from veins and crystals. The stone that is found in England, France and America, has not so fine a grain as that found in Germany, and therefore is inferior.

The stones are prepared for drawing by having their surfaces made smooth and uniform. The lines are drawn by the artist with a composition made of tallow, wax, shell-lac, common soap, and lamp-black, the usual proportion of which are—tallow, 2 oz.; shell-lac, 1 oz.; soap, 1½ oz.; and lamp-black, 1¼ oz. This composition, when undiluted, is formed into small rolls, and receives the name of crayon or graphic chalk. When diluted with water it is called lithographic ink, and in this form it is applied to the stone by means of steel pens or camel's hair pencils.

Drawings executed with the pen, are much the most durable, and many more impressions can be taken from them, than from those executed by means of the chalk.

It requires a good deal of skill in an artist to make a fine drawing on stone. The subject may be traced on the stone with red chalk or a lead pencil, but it must be done very lightly. When drawing, the artist must vary the pressure of the hand according to the tints which he wishes to obtain; or he may obtain any gradation of tint by varying the thickness of the lines or the distance at which they are placed from each other. A scraper is used to erase all errors and to procure lights.

When a drawing is finished, it is carried to the printer, who pours upon the stone diluted nitric acid, which produces a chemical change upon its surface, and discharges the alkali of the soap, which enters into the composition of the crayon and ink. This process is called etching. The stone is then covered with a solution of gum arabic, which fills up the pores, and prevents the ink from spreading. Previous to printing, the stone is wet with water, which is absorbed by every part of it except that which has been touched by the composition, for grease will not unite with water, while all calcareous stones possess the property of imbibing fluids, except they

be protected by oily substances. A roller is now charged with printing ink, and being made to pass over the stone, the ink readily adheres to the greasy lines of the drawing, but does not to those parts covered with water. The impressions are obtained in the same way as those from engravings. After each impression, it is necessary to wet the stone and apply the roller charged with ink.

It will be seen that the process of obtaining prints by lithographic engravings, is much less mechanical than any other mode, for it is founded upon a judicious application of chemical principles. The printer's ink being oily, readily unites with the oily composition which has been applied to the stone in drawing, while neither will unite with the water. These are the general principles upon which the art is founded. The number of impressions which can be taken from one lithographic drawing, when executed with the crayon, may vary from 500 to 1500, according to the fineness of the tints.

The art of lithography possesses many advantages over that of engraving. An engraving must be a copy, but a drawing on stone may receive many fine touches from the hand and skill of the artist. An impression from a copperplate can be transferred to stone by pressure, and then be printed in the same manner as if it had been originally drawn on the stone. The process of transferring an engraving to stone is extremely simple. The engraving must be laid with its surface upon water, until it becomes thoroughly wet, when it is taken and applied to the surface of the stone, which has been prepared in the usual manner. An equal pressure is now made by means of a roller, till the ink leaves the paper and adheres to the stone. The cheapness of lithographic prints brings them within the reach of all classes of society, and the works of authors which require embellishment, are by this art reduced in price.'

ANSWERS.

MESSRS. EDITORS—In a former number of your valuable and promising journal, I noticed a question asked by 'a master mechanic.' I would make a few remarks in reply, rather for the purpose of drawing the attention of other mechanics to the subject, than to propose any measures or a fixed plan by which the relations subsisting between masters and apprentices may be made mutually beneficial.

The subject is one of great importance, and well worthy the attention of all engaged in the arts.

In fixing upon a plan or articles of agreement between the mechanic and his apprentice, many things are to be considered, in order to protect the first from the non-fulfilment of his just claims upon the time of his apprentice, and to prevent the oppressive exercise of the power in the hands of the former over the latter. For this purpose it will appear evident, that the whole power ought not to be vested in the hands of the master, but rather that in case of difficulty occurring between them, a disinterested individual, or an association of individuals, should decide upon the proper claims of the parties concerned. To exemplify the

necessity of having some disinterested, or rather impartial association to appeal to, to whose decision both parties should be bound to accede, I would here notice one instance of not unfrequent occurrence. A boy at an early age is bound by his parent or guardian to remain until he is twenty-one years of age with a mechanic, for the purpose of learning a specified trade, without being consulted as to his inclination or taste for the trade he is to learn; or if he be consulted, he may not have acquired a taste for any particular one, or he may be deceived, and find after a few months' practice that he has not a taste for, or is incompetent to learn an art of his own selection. In a case of this kind the master may think it for his advantage to retain him in his employ to do the drudgery of the workshop, or menial offices unconnected with the trade it was intended he should learn. In either case the consequences ensuing would be in the highest degree injurious to the boy, and in the one before mentioned they would also be so to the master. In the former case more time and attention, and in many trades a greater loss of material, is required on the part of the master, while the latter years of his apprentice's time are less valuable to him, and on the part of the apprentice the best portion of his life is spent in acquiring a practical knowledge of his business, and the name of a *blundering workman.* I have given this example merely to show the injurious consequences resulting from the power of a selfish and unprincipled master over his apprentice; but were there no obligations by which the apprentice might be controlled, it is evident that the master might be the sufferer. But this is but one objection to binding an apprentice to a trade at an early age in the usual manner. Another equally strong is, that no provision is made for the intellectual and moral improvement of the boy. An apprentice may obtain much valuable information during his apprenticeship without neglecting his employer's work; for there are few occupations in which he may not be occasionally spared an hour or two from his labor, without interfering with or neglecting the duties of the workshop. In some manufactories and workshops an abundance of leisure is afforded, after the work of the day is ended, for mental cultivation; but in many, when the evenings are occupied by labor, little leisure is afforded except on Saturday evening and Sunday, the former of which is generally required for rest, and the latter occupied by attendance at church.

The great obstacle, therefore, that the apprentice has to encounter in his endeavor to obtain knowledge, is want of time. True there are none who might not devote an hour daily to this purpose, however closely their time may be required by their occupation; but it is to be remembered that when the body has become wearied by ten or twelve hours' labor, it requires a strong incentive to fix the mind upon any subject requiring close examination; and that the *rudiments* of science do not possess that incentive. The interest of the student is not awakened, his mind is not excited be the dry investigation of the elementary principles of the subject he pursues. It is necessary that he should overcome the first obstacles that present themselves, and acquire sufficient information to enable him to understand the general principles of the subject he investigates; and then the interest which is excited in him will enable him to overcome many difficulties, which to the young mind, in its first efforts, would have proved insurmountable obstacles.

The importance of scientific information to that class, above all others to whom these remarks are addressed, it is unnecessary to comment upon here. All must feel sensible of the advantages that are to be derived by the master, the apprentice and the world at large, by offering encouragement to young mechanics to obtain a theoretical knowledge of the business in which they are engaged, both as regards their standing in society and the greater perfection of the products of their labor, and also as affording them a rational means of enjoyment, which ,

after all, is the one great object toward which all our efforts are directed. This encouragment it is in the power of all, and it should be felt as a duty binding upon all our master mechanics, to offer to those whose time is placed at their disposal. A premium to attend the lectures which are now so bountifully opened to us in our city, together with an occasional evening for reading and experimenting, is all that is necessary on their part to produce so great an amount of good. J. H. B.

The four weights which would be required to weigh from 1 to 40 pounds with the common scales are, 1 of 1 pound—1 of 3 pounds—1 of 9 pounds—1 of 27 pounds. N. E. J.

The rule is, to multiply each weight by 3 for the next above it, commencing with 1. EDS.

In answer to the question in the last number of the Young Mechanic respecting the cider, I reply—1-3 as much cider will remain as the Barrel will hold, or 6 2-3 gallons of cider, and 13 1-3 gallons of water. D.

The following formula has been handed to us, but it gives a different answer from the above; and as both are without a demonstration, we cannot vouch for the correctness of either. EDS.

Calling the original quantity of cider $= a$, and the number of operations of drawing out and putting in water $= n$, the quantity of cider remaining after any number, n, of operation, will be

$\frac{a2 - a}{a + n - 1}$. Which will give nearly 39·75 pints, or about 5 gallons.

QUESTIONS.

Messrs. Editors—Being desirous of obtaining correct scientific and practical knowledge relating to the Mechanic Arts, I send you a short communication, in the hope that some enlightened and scientific mechanic will give some information concerning a process very common in various manufactures—that of rendering steel or iron of a beautiful blue color. The process is very simple, and perhaps so well understood by most mechanics, that they will not give it a moment's consideration; but I should like to be informed, what is the best method of producing an equally beautiful and permanent blue upon polished steel or iron, and also obtain a satisfactory answer to some questions that I shall ask relating to the process. In the first place, I will state that I attempted to produce a blue upon some small pieces of sheet iron, in which I was successful; but on applying a clean brush or the finger, the color was immediately rubbed off, leaving the surface as clean and bright as before. The operation was several times repeated with the same results. It is proper perhaps to state, that the surface of the iron was made smooth and burnished before bluing. Then why, in the above process, was the color so easily rubbed off? and what is it, in the composition of iron, that appears of such an elegant blue color when a certain degree of heat is applied, and which will appear from the same piece as often as made bright and heated? GULIELMUS.

Permit me through the medium of your publication, to ask some of your correspondents if they are acquainted with any composition, or oil paint, which will serve to put on large castings of iron, without their being heated, and when dry, to have the smoothness and appearance of japaned articles? A SUBSCRIBER.

Erratum.—Page 66, line 23d from the top, for *from* read *form*.